STATUS OF LEVEL 2 RETRIEVALS

JOEL SUSSKIND

AIRS TEAM MEETING

JUNE 2001

LATEST TEAM EXERCISE

RETRIEVALS FOR UNBIASED RADIANCES SIMILAR TO BEFORE

- MOST RETRIEVALS REJECTED OVER NORTH AMERICA, EURASIA
- RESULT OF MITCH'S REJECTION FOR "SCORE" GREATER THAN 1.5

NO SUCCESSFUL RETRIEVALS FOR BIASED RADIANCES

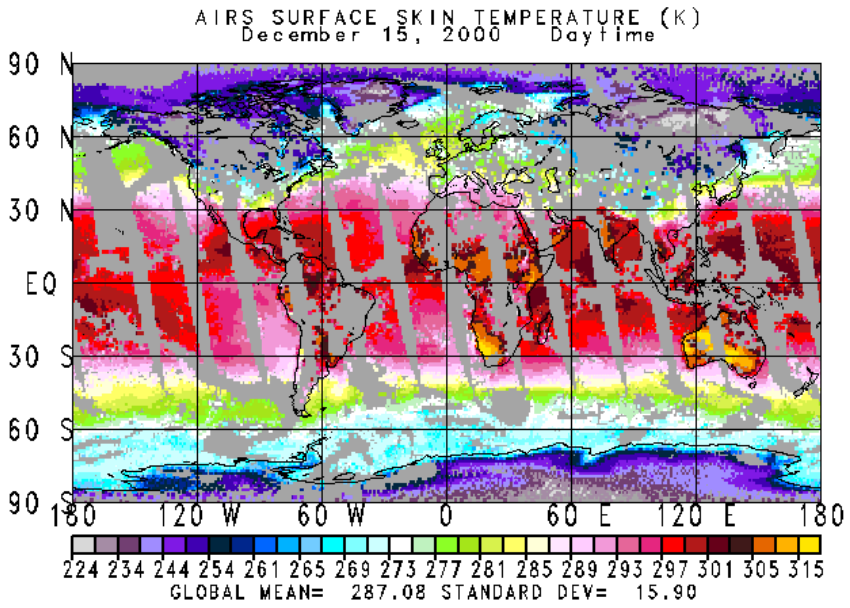
- FIRST PRODUCT NEVER DONE
- TWO POSSIBLE REASONS
  1) FIRST CLOUD CLEARED RADIANCES DON'T MATCH RADIANCES COMPUTED FROM MICROWAVE PRODUCT
  2) MITCH'S PRINCIPAL COMPONENTS DO NOT PREDICT OBSERVATIONS WELL ENOUGH

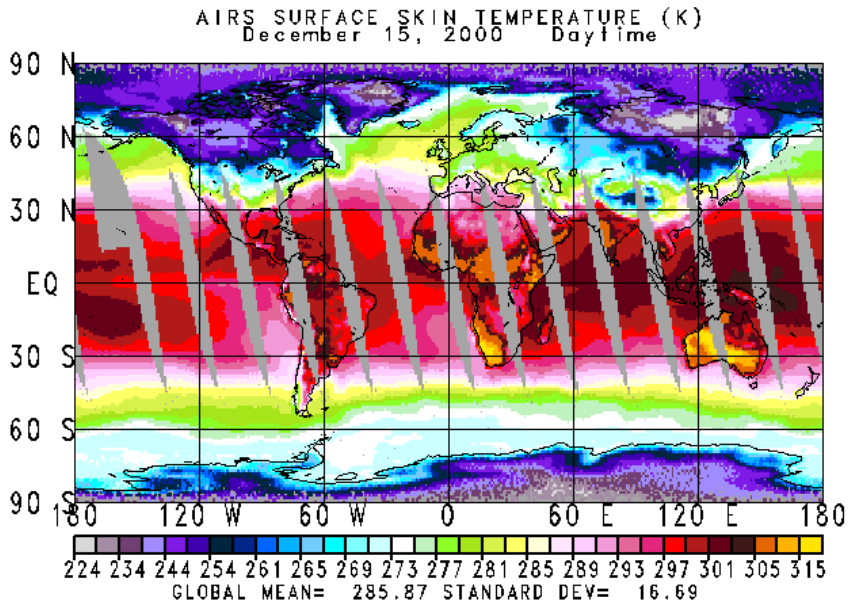
MOST LIKELY BOTH ARE CAUSING PROBLEMS

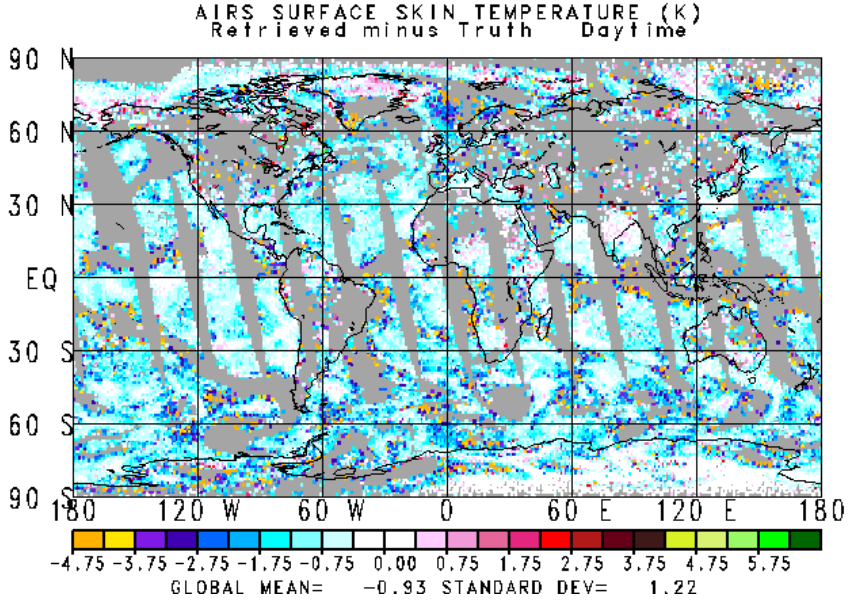
1) CAN BE FIXED BY USING TUNED COMPUTATIONS

RESULT IS PUZZLING BECAUSE WE DO NOT EXPECT REJECTIONS IF BIASES ARE CORRELATED WITH HEIGHT AND REASONABLY SMALL

June 2001 Exercise Unbiased Radiances







INDETERMINATE CLOUD CASES

IF THERE ARE CLOUDS AT TWO LEVELS WITH CLOUD FRACTIONS α_{JK} IN SPOT K

AND

$$\alpha_{2K} = A_0 + B\alpha_{1K}$$

THEN CLOUD LAYER TWO CANNOT BE DETERMINED FROM THE RADIANCES

$A_0 = 0$ IS A SPECIAL CASE OF A SINGLE CLOUD FORMATION

SPECIAL EXAMPLE

IF CLOUD LAYER 2 IS OVERCAST, AS SEEN FROM ABOVE

$$\alpha_{2K} = 1 - \alpha_{1K} \qquad A_0 = 1, B = -1$$

THE CLOSER CLOUD LAYER 2 IS TO BEING OVERCAST, THE MORE LIKELY IS THE CASE NEARLY INDETERMINATE

CURRENT JPL CLOUD SIMULATION

USES MEAN CLOUD FRACTIONS α_1, α_2 GENERATED FROM MODEL

$\alpha_{1K} = \alpha_1$ + RANDOM COMPONENT

$\alpha_{2K} = \left(1 - \alpha_{1K}\right)\alpha_2$ + RANDOM COMPONENT (SMALL)

$A_0 \approx \alpha_2 \quad B \approx -\alpha_2$

STANDARD DEVIATION OF $\alpha_{2K} - \left[\alpha_2 - \alpha_2\, \alpha_{1K}\right]$ IS SMALL

PROBLEM IS NEARLY ILL CONDITIONED

RETRIEVAL RESULTS WILL BE BIASED COLD - SECOND CLOUD FORMATION UNDERDETERMINED

THE LARGER A_0, THE WORSE THE PROBLEM - MORE SECOND CLOUD LAYER IS MISSED

FACTORS IN CURRENT REJECTION CRITERION

USES RETRIEVED CLOUD FRACTIONS α_{1K}, α_{2K}

FIT α_{2K} AS A STRAIGHT LINE AGAINST α_{1K}

$$\alpha_{2K} = A_0 + B\alpha_{1K}$$

χ^2 = QUALITY OF THE FIT

$$\chi^2 = \sum_{K=1}^{9} \left[\frac{\left(\alpha_{2K} - \left(A_0 + B\alpha_{1K}\right)\right)^2}{7} \right]$$

REJECTION CRITERION USES χ^2, A_0, AND NOISE AMPLIFICATION FACTOR A

NOISE AMPLIFICATION FACTOR A

$$\hat{R}_i = \overline{R}_i + \sum_{k=1}^{9} \eta_k \left(\overline{R}_i - R_{i,k} \right)$$

$$\overline{R}_i = \frac{\Sigma R_{i,k}}{9}$$

RANDOM NOISE ON $\hat{R}_i$ =A TIMES RANDOM NOISE ON $R_{i,k}$

$$A = \left[\sum_{k=1}^{9} \left(\frac{1}{9} \left(1 + \sum_{k'=1}^{9} \eta_{k'} \right) - \eta_k \right)^2 \right]^{1/2}$$

$A = 1/3$ IF ALL $\eta_k = 0$

$A \approx \left[\Sigma \eta_k{}^2 \right]^{1/2}$ FOR LARGE η_k BECAUSE FIRST TERM TENDS TO BE SMALL

THE LARGER A, THE MORE CLOUD CLEARING HAS TO BE DONE

A CLOSELY MATCHES MITCH GOLDBERG'S "SCORE"

ADDITION TO REJECTION CRITERIA

REJECT IF

A) $\chi^2 < 15 \text{ AND } A_o > 2 \text{ AND } A > 1$

OR

B) $\chi^2 < 10 \text{ AND } A_o > 5$

OR

C) $A > 2.0$

LAST TEST IS ONLY INDIRECTLY RELATED TO NEARLY INDETERMINATE CASES
NEAR INDETERMINATE CASES TEND TO HAVE LARGE η's

CURRENT JPL TEAM ALGORITHM REJECTS REGRESSION STEP IF "SCORE" $(\approx A) > 1.5$

THIS REJECTS A LARGE NUMBER OF CASES

I RECOMMEND LEAVING OUT "SCORE" TEST

THINGS TO DO BEFORE LAUNCH

FURTHER OPTIMIZATION OF REJECTION CRITERIA

- RECOGNIZE CASES WHERE REGRESSION IS POOR

IMPROVE WATER VAPOR RETRIEVALS

- THEY HAVE DEGRADED SERIOUSLY SINCE MORE CLOUD LIQUID WATER WAS ADDED TO THE SIMULATION IN FEBRUARY

PRODUCE CLOUDS, OLR IN CASES WHERE MICROWAVE RETRIEVAL IS REJECTED

- NEEDS PLUMBING FROM JPL
- CURRENTLY, SUBSEQUENT STEPS ARE BYPASSED

RECONCILE DIFFERENCES BETWEEN JPL SYSTEM AND GSFC SYSTEM

MAKE ALGORITHM ACCOMMODATE FEWER THAN 9 AIRS (OR HSB) SPOTS

MAKE ALGORITHM ACCOMMODATE MISSING CHANNELS GRACEFULLY

Insert talk1plots2to5.ps through 13